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# United States Patent [19]

Sigel

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## [54] REAL-TIME RECOGNITION OF POINTING INFORMATION FROM VIDEO

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[52] **U.S. Cl.** ..... **382/48**; 382/42; 382/16; 340/709

[58] **Field of Search** ..... 382/42, 59, 48, 19, 382/16; 340/706, 709

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[57] **ABSTRACT**

An occurrence of a predefined object in an image is recognized by receiving image data, convolving the image data with a set of predefined functions to analyze the image data into occurrences of predefined elementary features, and examining the occurrences for an occurrence of a predefined combination of the elementary features that is characteristic of the predefined object. Preferably the image data are convolved directly with a first predefined function to determine blob responses, and a second predefined function to determine ganglia responses indicating edges of objects. Then the ganglia responses are convolved with a third predefined function to determine simple responses indicating lines in the image, and the simple responses are combined with the ganglia responses to determine complex responses indicating terminated line segments in the image. A pointing finger, for example, is recognized from the combination of a blob response and a complex response. The method, for example, permits a data input terminal to recognize in real time the presence, position, and orientation of a pointing finger, to eliminate the need for data input devices such as "mice" or "joysticks." Therefore a user can direct an application program in the most natural way, without the distraction of manipulating a data input device.

**29 Claims, 11 Drawing Sheets**